Reacquire Identify and Localize Swimmers

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LONG TERM GOALS

The long term goal of this effort is development of a high speed UUV for intercept, localization and trailing of swimmers comprising a threat to ships in port. This vehicle is intended to close rapidly with a threat location to Reacquire, Identify, Localize Swimmers, with capabilities to track evading swimmers to support capture of threats.

OBJECTIVES

Technical Objectives in support of the long term goal include specification and design of an A-size (4.875" diameter) vehicle with integrated ultrasonic imaging and tethered RF buoy capable of supporting real time streaming of sonar images to a remote operator who can control the vehicle via the same RF link.

APPROACH

Our approach is to develop a swimmer defense UUV based on our other vehicles and on our notional CONOPS confirmed by sponsor. Development is based on a capabilities and requirements document aligned with the CONOPS. This document is then used as basis for a detailed work plan involving analysis, coordination with and providing of technical statements of work to outside suppliers of key hardware and software components, in support of internal mechanical design and fabrication efforts.

Vehicle hydrodynamic analysis and autopilot development is conducted by a subcontractor, with the autopilot to be integrated in the fabricated vehicle. Mechanical design is constrained by required center of buoyancy, center of gravity, fin placement, shape and performance, and shape guidance. As subsystems are assembled, they are benched tested and integrated for higher level system bench testing, followed thereafter by in water testing.

WORK COMPLETED

Work at Nekton is on schedule and under budget, with some work by subcontractors due before September 30, 2008.

At the kickoff in February 2008, we hosted a discussion with sponsor to confirm our notional CONOPS and performance specification of the vehicle, as was the schedule and locus for exit

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14. ABSTRACT
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demonstration at AUC Fest 09. Since kickoff, we have completed the capabilities and requirements document. We then produced a detailed work plan complete with milestones and personnel allocations. We then conducted a risk analysis and generated a risk areas document to further focus engineering effort.

As part of the engineering effort, we conducted an analysis of power budget for the vehicle, with propulsion, sonar imaging and wireless communications being key factors. Based on this analysis, we conducted a study of motors and batteries, and size selected components for these systems. Analysis of the processor requirements to support the autopilot and other vehicle software processes, we have identified a new processor capable of higher through put, having a floating point capability lacking in other candidates.

Initial requirements were provided to our imaging sonar provides, BlueView Technologies regarding frequencies, range capabilities and mechanisms of integration into the vehicle. In these discussions, we were provided estimates of maximum bandwidth required for streaming of uncompressed sonar images.

Based on estimated bandwidth requirements, we investigated COTS radios suitable for integration in a buoy to stream images and operator commands. Based on range and data rate capabilities, a WiFi radio from Silex was selected.

We then generated design concepts for the vehicle and the buoy as the basis for a Preliminary Design Review, which was conducted and a preliminary design was selected from the candidates as the basis for initiation of detailed design.

Initial hydrodynamic analysis by Vehicle Control Technologies is due for completion by September 30.

Prior to PDR, we specified MOOS compatible software modules for certain of the functions and adapted suitable others from our other UUV development efforts.

Following PDR, we generated an imaging requirements document that was provided to sonar device supplier, BlueView Technologies. As part of this process, we generated a detailed design for the sonar end cap to facilitate integration. We also updated the specifications document for the vehicle, buoy, tether and RF base station.

As part of vehicle specification we also conducted a weight and balance analysis of the vehicle before and after buoy release as the basis for analyzing stability and control of the vehicle in both states. We then conducted detailed design of the payload section of the vehicle and the battery portion of its payload. We have also partly completed detailed design of the buoy, tether, antenna and base station components of the system.

Critical design review is scheduled for September 30.

RESULTS

Since kickoff this past spring, the project has proceeded on schedule and budget.

Results include capabilities and requirements documents generated to support modular hardware and software designs and the operational capabilities confirmed with sponsor.

Detailed hardware design will follow Table 2 illustrates the software design implemented on Linux for our products including the dispenser

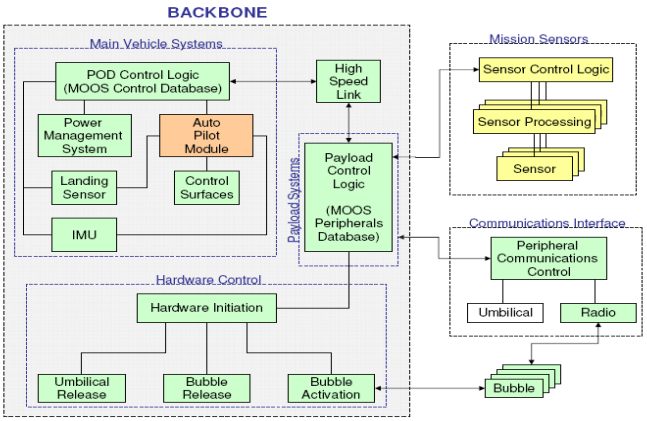

Table 3. Block diagram of dispenser software architecture Based on other devices developed for mine warfare

The hardware to support this software will be based on a newly selected processor family with floating point capabilities. Internal testing is now underway with the leading candidate hardware.

IMPACT

The UUV being developed to rapidly Reacquire Identify and Localize Swimmers is a high speed device supporting requirements for track and trail of divers posing a threat to ships in port and port infrastructure. The high speed for rapid closing with a threat and small man portable size for ease of deployment from dock or small boat combined with the ability of the system to provide high resolution images of the threat to a remote operator in real time and to permit the operator to control RILS once it has closed with the threat location will provide the Navy with the ability to quickly engage potential threats while at the same time avoid inadvertent injury to marine mammals or non-hostile divers.